

Technical Assignment #1:
Existing Lighting System Analysis &
Lighting Design Criteria For Selected Spaces



ANN AND RICHARD BARSHINGER LIFE SCIENCES & PHILOSOPHY BUILDING
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Lighting/Electrical Option
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Executive Summary:

The following report analyzes the current lighting system for the Barshinger Life Sciences & Philosophy Building. This analysis is based on the layouts, details, and descriptions contained in the construction documents and specifications. The actual space may differ slightly, but the general concepts and schemes should be the same. This report will examine the lighting system for the entire building, but will focus on six of the more critical spaces in detail. The Ecology Teaching Lab and the Humanities Common Room have been analyzed using AGI32 lighting software. Also being analyzed were the Atrium, the Lecture Hall, and two outer spaces: the East Entry façade and the Humanities Gardens. These six spaces represent both the most typical spaces that can be replicated throughout the building, as well as the showcase spaces that Franklin & Marshall College is especially proud of and wants to give a level of distinction and class.

In order to analyze the lighting design of this building, a great deal of information was taken from the construction documents. This included lighting layouts, luminaires, lamps, ballasts, and materials, among other details. Other sources, such as photography and online research, were also used to get a more complete picture of the spaces.

The majority of the building follows the theme of simple, clean, cost-effective, and efficient luminaires, which fit in well into the spaces and allow people to focus on the architectural and design elements of the spaces. The design was implemented very well and created a pleasing environment to work and relax in. That said, there are many elements of the lighting design that could be designed differently to meet other criteria, or could be improved in retrospect. Some of these elements are: exploring the use of ceramic metal halide lamps in place of many of the incandescent lamps; looking at more daylight control in the atrium and common room; simplifying the number of fixtures and types of lamps used in each space; exploring technologies not available when first designed; and accenting other surfaces (namely the East Entry façade). Exploration in these and other areas would help improve the aesthetics and functionality of an already strong design.



Evaluation of Entire Building Lighting System:

The Barshinger Life Sciences & Philosophy Building is the most expensive project Franklin & Marshall College has ever implemented on its campus. The college hopes that this building will help its programs in biology, philosophy, and psychology stand out from others. The first floor needs to be both inviting and impressive, as many guest speakers and other guests of the university will only see a few spaces on this floor. Public spaces on this floor have higher quality finishes and distinct architectural elements, and the lighting design should match and emphasize this. The second and third floors are comprised mostly of lab spaces and offices, so the lighting design in these spaces should be focused on the tasks of teaching, experimentation, and research.

A theme throughout the second and third floors seems to be simplicity. Most of the fixtures are used many times throughout the building. Most of the fixtures have a simple and clean look to them, and are both energy-efficient and cost-effective. Recessed fluorescent fixtures are used almost exclusively in the corridors and offices, which allows you to focus on some of the hidden architectural features of the space (the primary example of this are the niches created by the V-shaped corridors). While many of these spaces could have been designed using more task-specific luminaires, the design is nonetheless effective and was well executed.

For the majority of the spaces, the only lighting controls used are switches. Many of the classrooms feature a dual-switching system for multi-lamp fixtures and separate switching for wallwashers, but apart from that, the systems are mostly all-on or all-off. The spaces that do feature extensive lighting control systems are the Atrium, the Humanities Common Room, and the Lecture Hall, all of which will be detailed later. Daylight reaches the majority of spaces through windows that are approximately 4' wide X 8' tall. However, the only places that have the potential to be overwhelmed by daylight appear to be the Atrium, Humanities Common Room, and the greenhouse, which is almost entirely glass and generally has the goal of receiving as much daylight as possible.



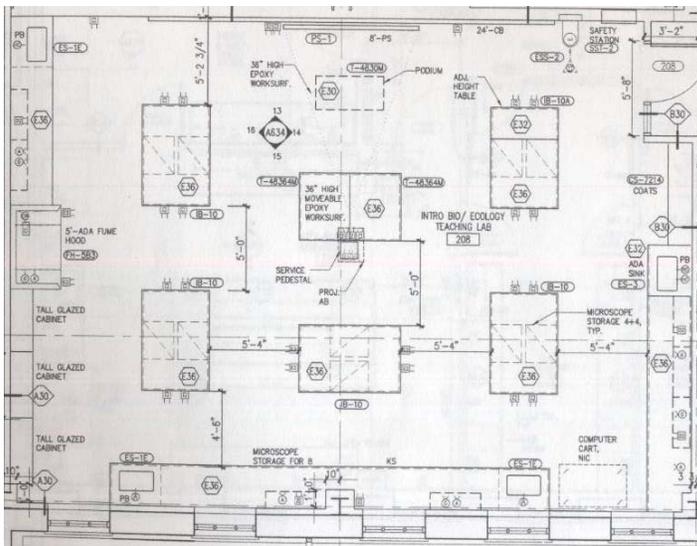
Ecology Teaching Lab

Existing Lighting Overview:

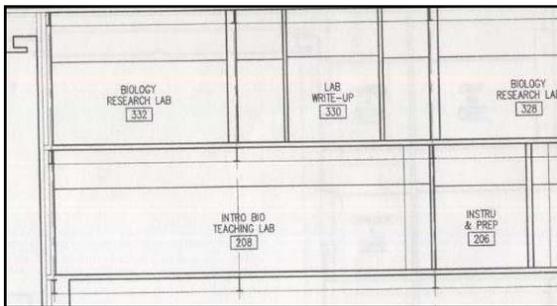
The ambient light for this space is created by recessed 1X4 T8 fixtures. The fixtures are grouped in pairs and distributed fairly evenly across the space. A set of recessed, 1X2 long twin tube fluorescent wallwashers is used to light the chalkboard.

Plans:

Floor Plan

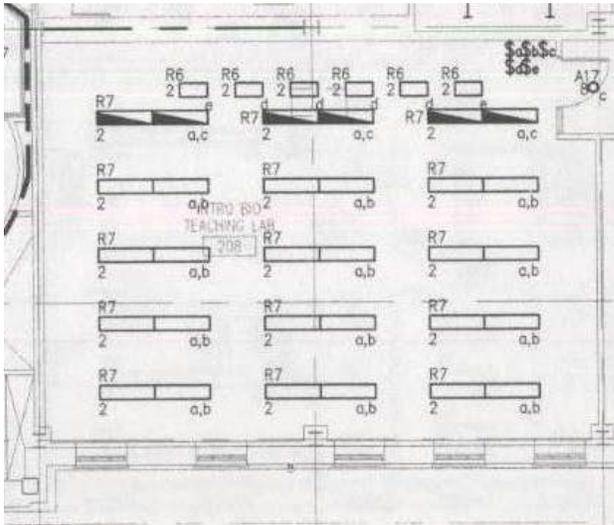


Section



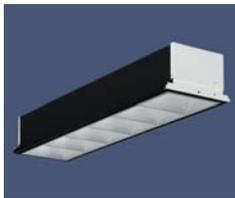


Lighting Plan



Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
R7	30	H. E. Williams	U4G-X14-232-16S-EB2-277	Recessed 1X4 static parabolic, with 3" deep, 8-cell, low iridescent aluminum louver	2	32W T8	277
R6	6	Zumtobel	RCW1-12-1405-PW-277-F	Recessed 1X2 wallwasher in a lay-in ceiling, white reflector, perforated housing	1	40W LTT	277



R7



R6

Ballast Schedule:

<u>Label</u>	<u>Ballast Type</u>	<u>Min. Power Factor</u>	<u>Min. Ballast Factor</u>
R7	Electronic Instant Start	0.98	0.85
R6	Electronic Rapid-Start	0.98	0.95



Light Loss Factors:

Label	LLD	LDD	RSDD	BF	Total LLF
R7	0.949	0.958	0.98	0.85	0.757
R6	0.9	0.958	0.98	0.95	0.803

Controls:

The two-lamp recessed fluorescent fixtures have separate switching for each lamp. The wallwashers switch separately from the downlights. Ballasts are non-dimming, so there are no provisions to dim this system.

Surface Characteristics:

Surface	Material	Color	Reflectance	Finish
Ceiling	acoustical ceiling tile	white	80%	matte
Walls	gypsum board	white	70%	matte
Floor	vinyl composition tile	white	55%	semi-specular
Floor	vinyl composition tile	blue	15%	semi-specular
Cabinets	wood	tan	30%	semi-specular
Worksurface	epoxy resin	black	10%	semi-specular

Daylight Elements:

Label	Quantity	Window Type	Mullion Pattern	Max Height	Max Width	Finish	Transmittance	Reflectance
A1	5	Rectangular	3X5	7'-10"	3'-8"	Clear	80%	5%

Furnishings:

Major furnishings include lab stations with a workplane at 3' AFF, a podium workstation at the front of the room, sink cabinets, storage shelving, and other safety equipment. A chalkboard and a retractable projection screen will also be furnished.



Illuminance Requirements:

IESNA Reference: Classrooms – Science Laboratories

Horizontal Illuminance: 50 fc

Vertical Illuminance: 30 fc

Analysis: Appropriate for this environment

Power Density (ASHRAE 90.1 2004):

ASHRAE Reference: Laboratories

Power Density: 1.4 W/ft²

Additional Allowance: none

Approximate Floor Area: 1160 ft²

Approximate Power Allowance For Space: 1624 W

Design Criteria:

Most Important:

Color Appearance and Color Contrast:

- The experiments being performed in this laboratory require the experimenter/student to be able to distinguish subtle differences in color, as well as to be able to correctly decipher color to begin with. A high CRI source would be required.

Light Distribution on Task Plane:

- In order to have a reasonably controlled environment for all experiments, it is best to have each lab station as identical to the next as possible. This includes having approximately the same illuminance and luminance levels. Also, in order to make it equally possible to learn from any place in the room, it would be practical to make the workstations as uniformly lit as possible.



Luminances of Room Surfaces:

- The chalkboard is a major task in this room, and it is imperative that the chalkboard is lit well enough to be seen. However, it is also critical that the chalkboard is not overwhelmed with light, as that would reduce the contrast between the chalk and the board, and thus would become more difficult to read.

Modeling of Faces and Objects:

- This is critical if the professor is planning on performing demonstrations in front of the class, which based on the layout of the lab, appears to be the case. The students need to be able to see distinct features of objects both at their station and the professor's. Good facial rendering is also a critical part of the learning process, as being able to see what the professor is saying both connects the professor to his/her audience and helps reinforce the information they are hearing.

Points of Interest:

- Major tasks to focus on are the chalkboard and the individual workstations. A task lighting system might be a good way to emphasize the importance of these areas.

Also Important:

Source/Task/Eye Geometry:

- Objects used during labs may be specular or glossy. If a direct lighting system is used, it is important to consider where a person is likely to sit/stand and where they are likely to view glossy objects.

Surface Characteristics:

- The major task surfaces (the workstation and the chalkboard) are very low reflectance. Generally, more light than normally required will be needed to work well in this space.



Special Considerations (VDT/Projection Screen):

- The projection screen will be over the chalkboard. Any lighting specifically for the chalkboard must be controlled separately from the rest of the space, so that people may still see to take notes during presentations. Any ambient light should be examined to make sure there isn't a significant amount striking the projection screen.

Illuminance (Horizontal and Vertical):

- Good illuminance is required to learn and to perform detailed experimentation. Appropriate horizontal illuminance is needed on the workstations, and appropriate vertical illuminance is required on the chalkboard.

AGI Model:

View 1





View 2





Lighting Analysis and Critique:

The underlying concept for the space is sound. The concept is a strong ambient system so that the space can be flexible, and a wallwasher specifically for the chalkboard. This may have also been a case where the majority of the furnishings were not known when the lighting design was performed.

I analyzed this space in AGI32, and I calculated the horizontal illuminance at 3' above the floor (the height of the workplane). The average illuminance for the space was 99 fc, with a maximum of 133 fc and a minimum of 35 fc. This is significantly higher than the recommended 50 fc for most laboratories, and creates darker work areas at the edge of the space. There is a possible explanation for this: a couple of experiments in this room may require even greater distinction between objects and may use smaller objects than normal. This would require the space to be designed to 100 fc, and be switchable down to 50 fc (which is exactly how the space was designed). That said, the room will almost always be operating in the one-on, one-off mode. It may be more practical to design the entire room to only 50 fc, and use extra task lights to get the 100 fc as needed.

I also calculated the vertical illuminance of the chalkboard. The average illuminance was 35 fc, with a maximum of 39 fc and a minimum of 26 fc. Because the chalkboard is a very dark surface, it may be a little shy of what is actually needed on the board. That said, the chalkboard should have fairly good legibility and contrast.

I will try to use a task-oriented approach to light this space. It may involve a slightly more complex system than the current one, but by focusing on the tasks first, I think it will result in a uniform and more appropriate illuminance on every worksurface, which is the one thing that might be missing from the space.



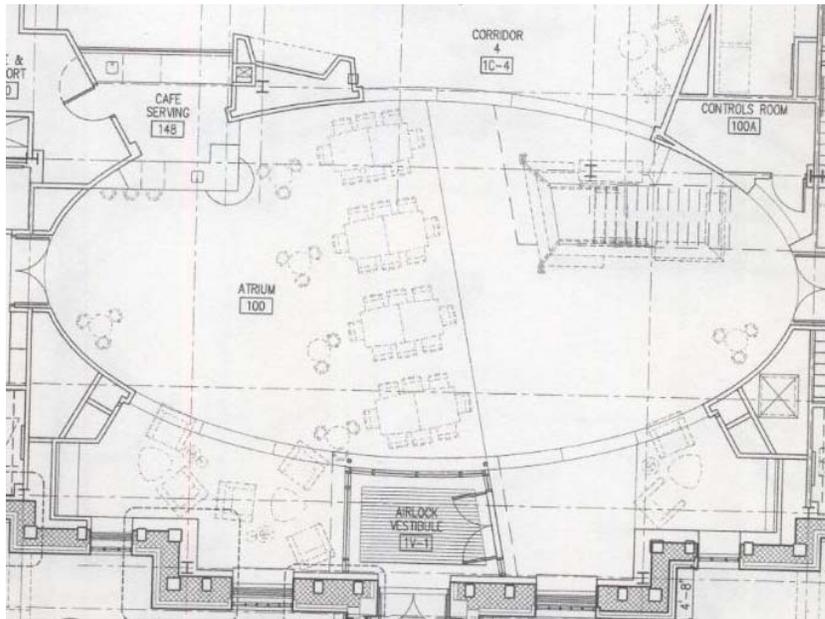
Atrium

Existing Lighting Overview:

Daylight gains makes up a large amount of the light in the space. A daylight sensing photo cell is used to determine how much artificial light and where artificial light is required. Much of the artificial light that reaches the ground comes from a line of 200W incandescent track fixtures over the middle of the space. Two relatively compact custom pendants are also mounted over the middle of the space. The pendants consist of 9 4 foot T8 lamps for general ambient light, 3 halogen downlights, and 3 Long Twin Tube lamps used for uplighting. A cold-cathode system is used to uplight the cove area and emphasize the edge of the acoustical wood ceiling. Other wall-mounted track fixtures and recessed downlights put light on the walls and work areas.

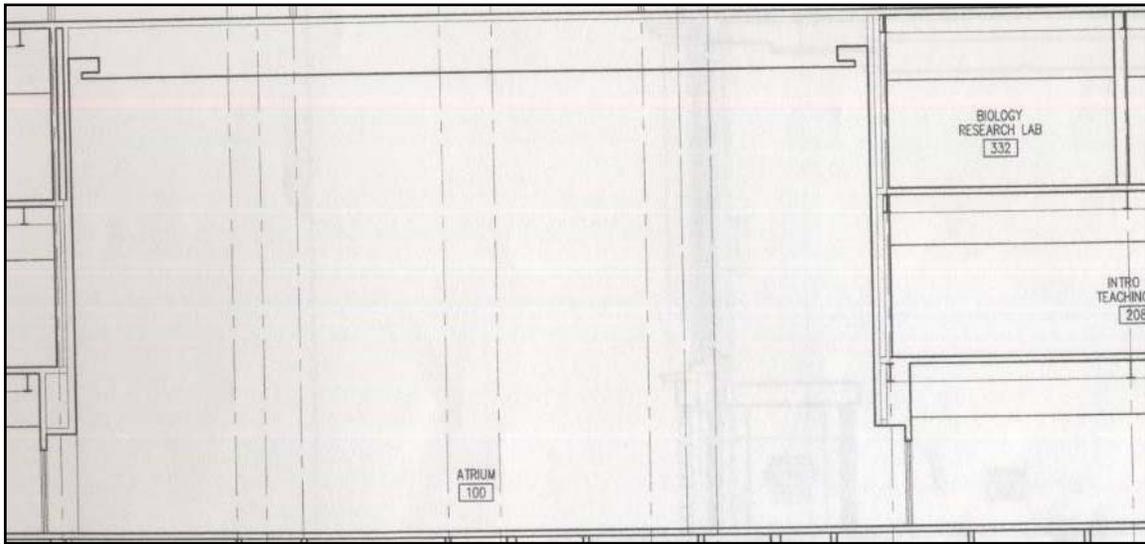
Plans:

Floor Plan

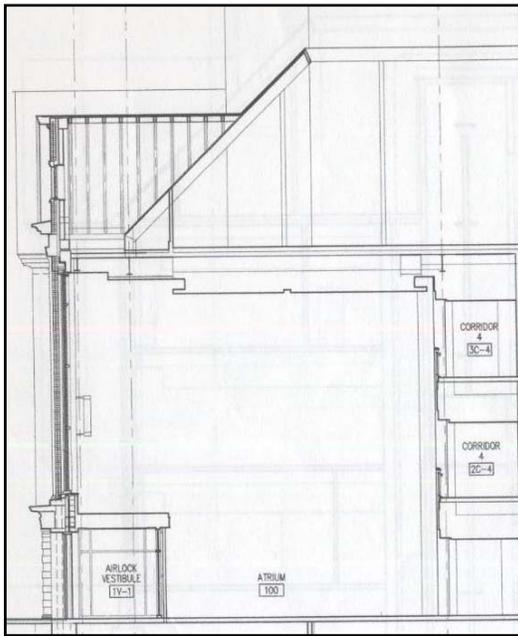




Section 1

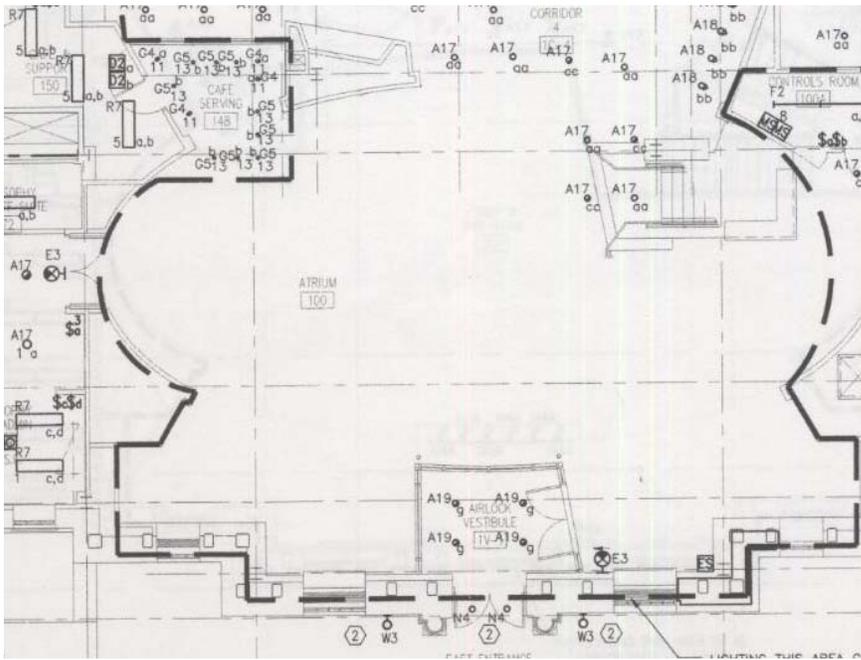


Section 2

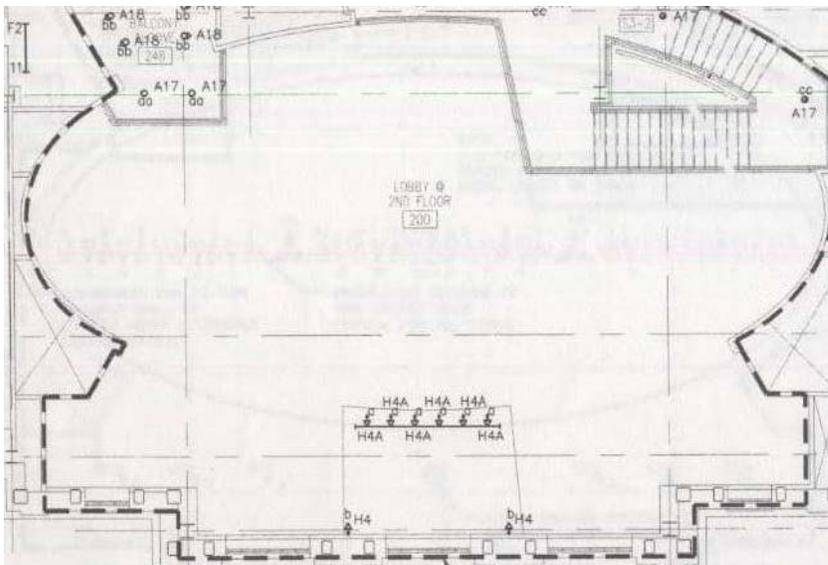




Lighting Plan – First Floor

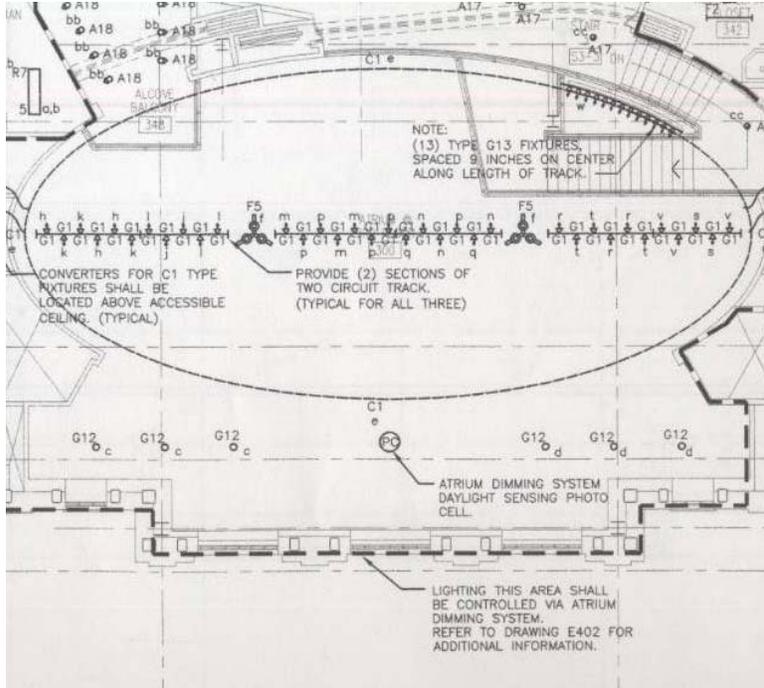


Lighting Plan – Second Floor





Lighting Plan – Third Floor





Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
H4	2	Lighting Services, Inc (LSI)	300-5-LOUVERE-E990-B	Spotlight with linear spread lens	1	200W PAR56/MFL	120
H4A	6	Lighting Services, Inc (LSI)	300-00-LOUVERE-E998-B-TRACK: 31000 Series	Spotlight with beam softening lens on track	1	200W PAR56/MFL	120
C1	100	National Cathode Corp.	SE-H-LST-C-3000K-80CRI	Single row of 25mm cold cathode lamps mounted in cove	1	27 VA/FT Cold Cathode	277
G12	6	Gotham	APR-PAR38-6MB	6" recessed round downlight with black baffle	1	100W PAR38	120
G13	13	Lighting Services, Inc (LSI)	46-00F-CrossBaffleA-(AR-36)-Lens A992-75AR111/8/SP-B	Track spotlight with linear spread lens	1	75W AR111/8/SP	12
G1	35	Lighting Services, Inc (LSI)	300-00-LOUVERE-E998-B-TRACK: 32000 Series	Spotlight with beam softening lens on track	1	200W PAR56/MFL	120
F5	2	Winona	Custom Fixture	Custom pendant with 3 opal acrylic tubes each housing 3 T8 lamps. Bottom of tube houses halogen downlight, and brass cruciform supporting the 3 tubes houses LTT uplights.	9 3 3	32W T8 75W PAR30S 36W LTT	277 120 277



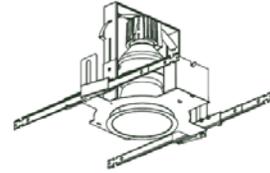
H4



H4A



C1



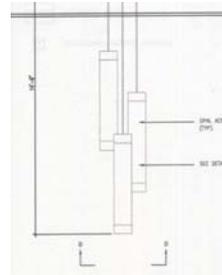
G12



G13



G1



F5

Ballast Schedule:

<u>Label</u>	<u>Ballast Type</u>	<u>Min. Power Factor</u>	<u>Min. Ballast Factor</u>
H4	none	-	-
H4A	none	-	-
C1	HPB-200mA	high	-
G12	none	-	-
G13	none	-	-
G1	none	-	-
F5	Electronic Rapid-Start	0.98	0.95



Light Loss Factors:

Label	LLD	LDD	RSDD	BF	Total LLF
H4	0.95	0.88	0.952	1	0.796
H4A	0.95	0.88	0.952	1	0.796
C1	1	0.865	0.854	1	0.739
G12	0.95	0.877	0.952	1	0.793
G13	0.95	0.88	0.952	1	0.796
G1	0.95	0.88	0.952	1	0.796
F5	0.9	0.934	0.912	0.95	0.728

Controls:

Manufacturer/Family	Product	Quantity	Catalog #	Details
Lutron Grafik Eye	Master Control Unit	1	GRX-4524-A-WH	
Lutron Grafik Eye	Programmer Interface	1	GRX-PRX	
Lutron Grafik Eye	Two-Button Entrance Control	3	SG-RS-RB-N-WH-E	Entry; 1 Scene and Off
Lutron Grafik Eye	Six Scene Controller	1	SGRX-6S-N-WH-E	main control for space



Surface Characteristics:

Surface	Material	Color	Reflectance	Transmittance	Finish
Flat Ceiling	gypsum board	white	70%	-	matte
Acoustical Ceiling	wood slat panel	brown	15%	-	matte
Counter	bluestone	grey	15%	-	matte
Floor - Sitting	carpet	dark grey	20%	-	matte
Floor - Circulation	terrazzo	light grey	45%	-	semi-specular
Steps	terrazzo	grey	35%	-	semi-specular
Main Walls	gypsum board	white	70%	-	matte
Benches	wood	brown	15%	-	semi-specular
Balcony Panels	wood veneer panels	brown	15%	-	semi-specular
Decorative Wall	laminated glass	blue	5%	30%	specular
Railings	wood	brown	15%	-	semi-specular
Rail Supports	steel	dark grey	20%	-	matte
Rail Sides	translucent glass	clear	10%	40%	specular
Vestibule Ceiling	wood	brown	15%	-	semi-specular
Vestibule Trim	wood	brown	15%	-	semi-specular



Daylight Elements:

<u>Label</u>	<u>Quantity</u>	<u>Window Type</u>	<u>Mullion Pattern</u>	<u>Max Height</u>	<u>Max Width</u>	<u>Finish</u>	<u>Transmittance</u>	<u>Reflectance</u>
A1	6	Rectangular	3X5	7'-10"	3'-8"	Clear	80%	5%
C	2	Rectangular	5X5	7'-10"	5'-4"	Clear	80%	5%
H	3	Arched Radius	7X15 + arch	25'-11"	7'-0"	Clear	80%	5%

Furnishings:

A counter is provided for the café at the back end of the space. Other mobile furnishings will include couches, armchairs, and coffee tables.

Illuminance Requirements:

IESNA Reference: Hotels – Lobby – General Lighting (closest equivalent)

Horizontal Illuminance: 10 fc

Analysis: During the day, the daylighting should provide more than this by itself. At night, there are going to be task locations that require 30 fc (particularly the café cashier station and the work areas).

Power Density (ASHRAE 90.1 2004):

ASHRAE Reference: Atrium – First Three Floors

Power Density: 0.6 W/ft²

Additional Allowance: 1.0 W/ft² for Decorative

Approximate Floor Area: 2300 ft²

Approximate Power Allowance For Space: 1380 W + 2300 W decorative



Design Criteria:

Most Important:

Appearance of Space and Luminaires:

- This space is the first that nearly every person entering the building will see, and this includes guests of the university. It is important that this space appears to be impressively aesthetically and also relaxing. High quality finishes were used here, so equally high-quality luminaires with pleasing aesthetics should be used.

Daylight Integration and Control:

- There is a very large amount of window area on the east wall of the space, and they have the potential to bring enough light into the space for all functions. The glass area is so large, however, that it is probable that too much light is going to enter the space, and good control of this light is critical.

Modeling of Faces and Objects:

- This is a requirement for the café area. Adequate light on faces, food, and menus is needed in order to conduct business. Also, way-finding is a critical task in this space, and being able to pick up on visual cues as to where to go requires a great deal of light on these objects.

Points of Interest:

- The open stairs and balconies are dominant elements of the space, so highlighting these areas would probably be a good idea. I'd also like to emphasize the work areas with more light than the general circulation areas.



Also Important:

Direct Glare:

- This related more to the daylight entering the space. If not shielded properly, it could become impossible to do work in some areas of the spaces during certain daytime hours.

Shadows:

- In order to create a relaxing atmosphere, shadows can create bits of visual interest and help the space appear more natural.

Source/Task/Eye Geometry

- One of the tasks in this space will be casual reading. If the reading material is particularly glossy, it's going to be important to look at how the daylight is going to reflect off of the reading.

Surface Characteristics:

- The wood ceiling has some gloss to it, so a primarily indirect system would not be very effective here. The terrazzo flooring also is somewhat specular, so any high-intensity beams are going to be reflected strongly off of the floor, which could create some glare.

System Control and Flexibility:

- Daylight sensing controls are important, as is adapting the system to both day and nighttime use. Different scenes might be good for receptions and regular work.



Lighting Analysis and Critique:

One of the major areas for improvements in this space would be use of higher-
efficacy, longer life sources. The space by itself greatly exceeds ASHRAE standards
(though I'm assuming this was made up for in other spaces). Replacing the
incandescent downlights with ceramic metal halide would reduce the energy
required and the frequency of re-lamping. In addition, any major visual differences
in the lamps are negated by the 40' height of the space, and a slightly cooler metal
halide might blend in better with the very cool daylight.

This system would do a relatively good job at modeling faces and objects. The
fixtures can mostly be adjusted to suit the needs of the space, so more light can be
focused on the café area or the work areas if need be. Also, the use of track systems
and custom pendants gives the space an air of sophistication and class that I'm sure
the university was targeting.

The cold cathode system is not necessarily a bad choice in this room. Maintenance
in this room is complicated, particularly at the ceiling, and cold cathode is a very
long life source with good color and decent output. This design was made back in
2005, when LED technologies were not what they are today. With better directional
control and ease of installation, I think LED might be a viable option here. Careful
analysis is needed to create a system that is equal or better than the one already in
place.

In the morning, this space is going to be flooded with daylight, and some sort of
shading or shielding would help the space remain usable during this time. Shades
may not be an option here, considering the very public nature of the space.
However, overhangs and landscaping may help a lot.

Once again, there are some very strong qualities to this design. Further exploration
into sources used in the space may make the space even stronger.



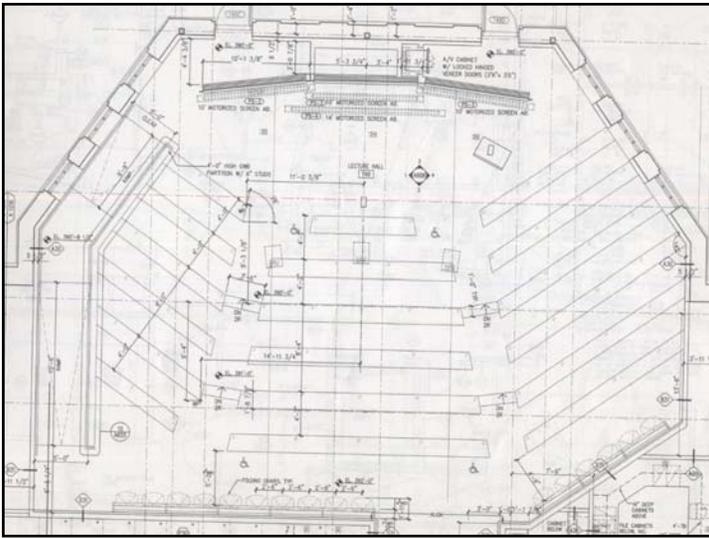
Lecture Hall

Existing Lighting Overview:

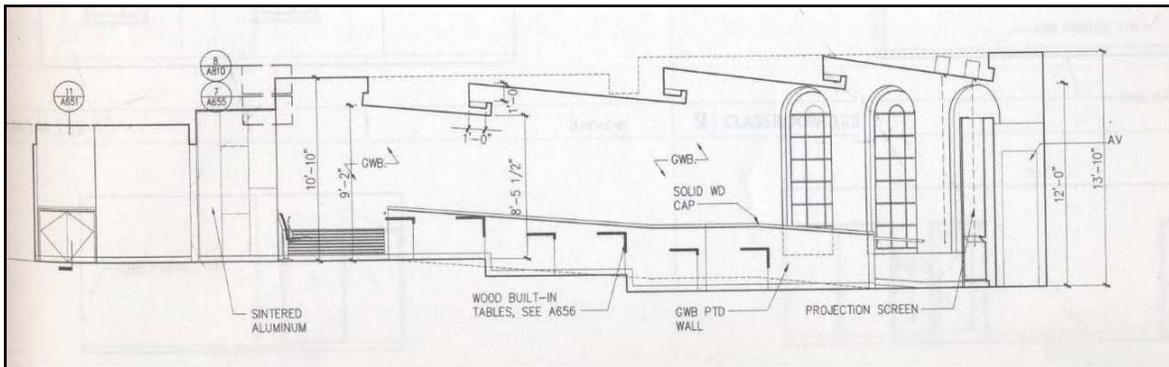
General lighting for the space is provided by recessed linear fluorescent downlights over the work tables and CFL downlights on the edge of the space. The cove is lit using a striplight system. The podium and stage are accented by adjustable track lights. Wallwashers and recessed steplights complete the design.

Plans:

Floor Plan

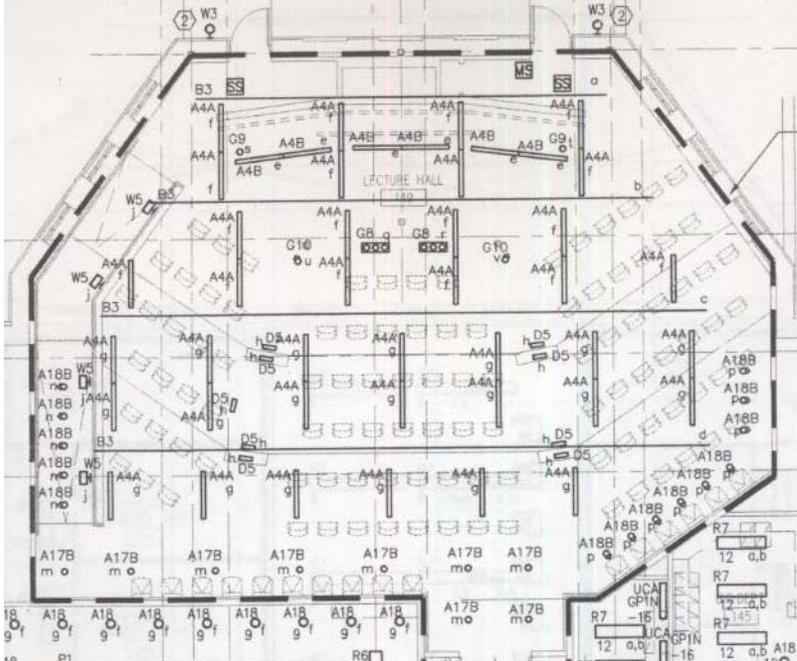


Section





Lighting Plan



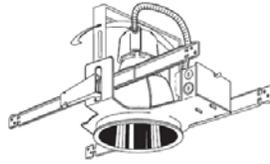


Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
B3	100	Lithonia	S-1-32-277-ECO10	Striplight mounted in cove	1	32W T8	277
A18B	14	Gotham	AFVW-26TRT-6AR-LD-277-DMHL	6" recessed round wallwasher	1	26W TRT	277
W5	4	Cole	F2159-G-13-J-Raw Brass Face Plate-TP-277	Compact fluorescent steplight for use on wheelchair ramp	1	13W TT CFL	277
A4A	38	Linear Lighting	RC68-D-2-ET8-277-PBW-F-BW-ED-48"	Recessed linear fluorescent downlight with matte white parabolic louvers	2	32W T8	277
A17B	9	Gotham	AFV-32TRT-6AR-LD-277-DMHL	6" recessed round downlight	1	32W TRT	277
D5	8	Cole	F157G-J(Back Mounted)-Raw Brass Face Plate-TP-277	Compact fluorescent steplight for use on steps between levels	1	13W TT CFL	277
G9	2	Gotham	APR-PAR30-6AR-LD	6" recessed round downlight with semi-diffuse finish	1	75W PAR30S	120
G10	2	Gotham	DP-PAR16-30S-6-AC-T30-LD	Halogen adjustable accent light	1	75W PAR30S	120
A4B	6	Linear Lighting	RC68-D-2-ET8-277-RBW-F-BW-LO-ED-48"	Recessed linear fluorescent downlight with louver overlay	2	32W T8	277
G8	2	RSA Lighting	CO1700IS-WH-BK-YK-CC-Baffle-Linear Spread Lens	3-lamp recessed adjustable accent lights	3	75W PAR30S	120



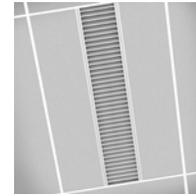
B3



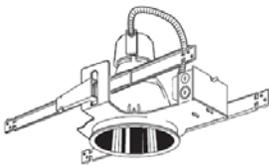
A18B



W5



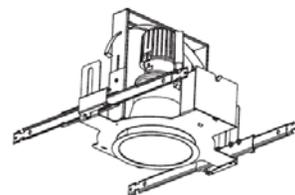
A4A



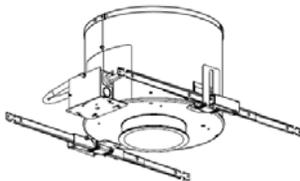
A17B



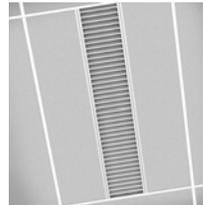
D5



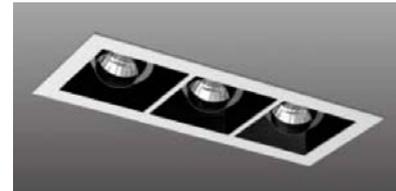
G9



G10



A4B



G8

Ballast Schedule:

<u>Label</u>	<u>Ballast Type</u>	<u>Min. Power Factor</u>	<u>Min. Ballast Factor</u>
B3	Lutron ECO-10 Dimming	0.95	0.85
A18B	Electronic Rapid-Start	0.98	0.85
W5	Electronic Rapid-Start	0.98	0.85
A4A	Lutron ECO-10 Dimming	0.95	0.85
A17B	Electronic Rapid-Start	0.98	0.85
D5	Electronic Rapid-Start	0.98	0.85
G9	none	-	-
G10	none	-	-
A4B	Lutron ECO-10 Dimming	0.95	0.85
G8	none	-	-



Light Loss Factors:

Label	LLD	LDD	RSDD	BF	Total LLF
B3	0.949	0.96	0.948	0.85	0.734
A18B	0.85	0.958	0.884	0.85	0.612
W5	0.85	0.947	0.948	0.85	0.649
A4A	0.949	0.958	0.948	0.85	0.733
A17B	0.85	0.958	0.948	0.85	0.656
D5	0.85	0.947	0.948	0.85	0.649
G9	0.95	0.958	0.948	1	0.863
G10	0.95	0.958	0.948	1	0.863
A4B	0.949	0.958	0.948	0.85	0.733
G8	0.95	0.958	0.948	1	0.863

Controls:

Manufacturer/Family	Product	Quantity	Catalog #	Details
Lutron Grafik Eye	Master Control Unit	1	GRX-4524-A-WH	
Lutron Grafik Eye	Programmer Interface	1	GRX-PRX	
Lutron Grafik Eye	Two-Button Entrance Control	1	SG-RS-RB-N-WH-E	Entry; 1 Scene and Off
Lutron Grafik Eye	Four Scene Controller	2	SGRX-4S-N-WH-E	main controls for space

Surface Characteristics:

Surface	Material	Color	Reflectance	Finish
Side Walls	gypsum board	white	70%	matte
Back Walls	sintered aluminum panels (AWT)	silver	40%	semi-specular
Screen Walls	enamel steel clad	dark grey	10%	matte
Floor	carpet	grey	20%	matte
Desks - Trim	light wood	tan	30%	semi-specular
Desks - Top	plastic laminate	light grey	50%	matte
Railing - Top	wood	tan	30%	semi-specular
Railing - Sides	gypsum board	white	70%	matte
Ceiling - Seating	gypsum board	white	70%	matte
Ceiling - Edge	acoustical plaster	white	79%	semi-gloss



Daylight Elements:

<u>Label</u>	<u>Quantity</u>	<u>Window Type</u>	<u>Mullion Pattern</u>	<u>Max Height</u>	<u>Max Width</u>	<u>Finish</u>	<u>Transmittance</u>	<u>Reflectance</u>
J1	6	Arched Radius	3X6 + arch	9'-4"	3'-8"	Clear	80%	5%

Furnishings:

Build-in elements include wood-trimmed laminate tables and chairs for audience members. A projection screen (which is retractable but frequently in use) is also built-in

Illuminance Requirements:

IESNA Reference: Lecture Halls (audience/demonstration), #2 pencil/photocopies

Horizontal Illuminance: 100 fc (demonstration), 30 fc (audience)

Vertical Illuminance: 50 fc

Analysis: Vertical illuminance is appropriate, but horizontal illuminance on the demo area is way too high here (the slope of the space is not as great as many lecture halls, and vertical illuminance becomes more critical). I will design the stage area for 70 fc.

Power Density (ASHRAE 90.1 2004):

ASHRAE Reference: Classroom/Lecture/Training

Power Density: 1.4 W/ft²

Additional Allowance: none

Approximate Floor Area: 2500 ft²

Approximate Power Allowance For Space: 3500 W



Design Criteria:

Most Important:

Appearance of Space and Luminaires:

- Many of the guest lectures and presentations for the entire university will be taking place in this room. The space should look very professional, and the fixtures should be generally recessed or aesthetically clean.

Light Distribution on Task Plane:

- Every desk in the lecture hall should be equally lit, so that there is no place in the room where it is more difficult to learn from.

Modeling of Faces and Objects:

- In presentations and demonstrations, it is critical for audience members to be able to see the presenters and details of any objects they are using. It is also critical for the faces of the audience to be somewhat lit, so that the presenter can pick up visual cues that he/she is getting their point across, and can try other things if one method is not working.

Points of Interest:

- The two major focus areas in the space are the podium and the coves, and lighting should be used to effectively accentuate these areas.



Special Considerations (VDT/Projection Screen):

- Nearly all presentations in this space will be in PowerPoint / digital format, so the projection screen is a critical taskplane. Because the presentations in this room are professional in nature, it is not acceptable to simply shut off all of the lights in the room when the projection screen is being used. A high quality design will put light on the speaker and audience without adding extra light to the screen.

System Control and Flexibility:

- At least two different scenes would be great in this space; one to be used for presentations on the projection screen, and one to be used for before and after presentations that allows more light on the stage.

Also Important:

Color Appearance and Color Contrast:

- Any demonstrations that occur as part of presentation will require reasonably good color contrast.

Shadows:

- The lighting system cannot create any shadows over the projection screen, both because of the physical fixture and the visual effects caused by the lighting system.

System Control and Flexibility:

- At least two different scenes would be great in this space; one to be used for presentations on the projection screen, and one to be used for before and after presentations that allows more light on the stage.



Illuminance (Horizontal and Vertical):

- Good horizontal illuminance is required for notetaking. Good vertical illuminance is required for reading off the vertical surfaces of the space (which may include a chalkboard or whiteboard)

Lighting Analysis and Critique:

The control system designed for this space was very strong. The three lamps generating the most light in the space (the two types of recessed fluorescents and the cove striplights) are fully dimmable, and the entire lighting system can be combined into four different scenes, which is great for this space.

The recessed fluorescents certainly provide enough light and light the workplane pretty evenly. but in a professional space like this, I might be more inclined to use more smaller sources over the desk and make the cove system more powerful and more efficient. Linear fixtures tend to make spaces read more like classrooms, which is not what the design goals are for this room.

The stage and podium areas are distinguished very well with lighting. Using an adjustable, multi-lamp fixture was a great choice here for non-VDT presentations. Some of the recessed fixtures overlap both the audience and presentation areas, and I'd be concerned that a good bit of light from these fixtures would reach the screen, making it harder to read the screen. Changes in elevation within the space (i.e. the steps and the ramp) are lit very well, and people shouldn't have a problem getting through the space.

Overall, I will be taking a more task-oriented approach to the lighting design in this space, looking at smaller sources and restricting the light that would hit the projection screen.



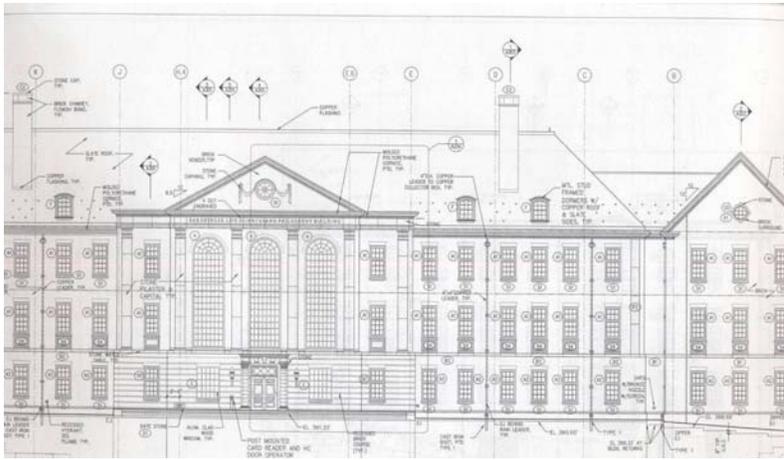
East Entry Facade

Existing Lighting Overview:

The lighting consisted of 8' poles to light the walkway, decorative wall sconces and recessed lighting to light the entrance, and steplights to light the handicap ramp.

Plans:

Elevation



Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
W3	2	Antique Street Lamps	DL42-100M MED-ACT- 277-ANBK- ACAWB	Wall mounted decorative exterior sconce	1	100W MH	277
N4	2	B-K Lighting	HP2-MR-TR- 8-BLP-10-277	Recessed downlight over building entrance	1	50W HAL FL	12
N5	6	Cole	F15-13G- J(Back Mounted)- Raw Brass Face Plate-TP- 277-W	Wall recessed compact fluorescent steplight for use on ramps	1	13W TT CFL	277
N1	2	W. J. Whatley	1004-150-W- 277-MT-T-BK- F	Acorn-style decorative lighting on 8' pole for lighting sidewalks	1	150W MH	277



W3



N4



N5



N1

Ballast Schedule:

<u>Label</u>	<u>Ballast Type</u>	<u>Min. Power Factor</u>	<u>Min. Ballast Factor</u>
W3	Magnetic HID	0.9	-
N4	none	-	-
N5	Electronic Rapid-Start	0.98	0.95
N1	Magnetic HID	0.9	-

Light Loss Factors:

<u>Label</u>	<u>LLD</u>	<u>LDD</u>	<u>RSDD</u>	<u>BF</u>	<u>Total LLF</u>
W3	0.65	0.78	1	1	0.507
N4	0.95	0.78	1	1	0.741
N5	0.85	0.78	1	0.95	0.630
N1	0.65	0.78	1	1	0.507

Controls:

<u>Manufacturer/Family</u>	<u>Product</u>	<u>Quantity</u>	<u>Catalog #</u>	<u>Details</u>
Interface K4000	Photocell	1	-	mounted on roof; determines when exterior fixtures will be turned on



Surface Characteristics:

<u>Surface</u>	<u>Material</u>	<u>Color</u>	<u>Reflectance</u>	<u>Finish</u>
Main Façade	brick	burnt red	30%	matte
Pilasters / Columns	stone	beige	40%	matte
Carvings	stone	beige	40%	matte
Cornices	polyurethane	beige	40%	semi-gloss
Ground	grass	green	18%	matte
Walkways	concrete	pale pink	40%	matte
Entry	precast concrete unit pavers	grey	20%	matte
Window / Door Trim	painted wood	white	70%	matte

Illuminance Requirements:

IESNA Reference: Building Exteriors – Entrances - Active

Horizontal Illuminance: 5 fc

Vertical Illuminance: 3 fc

Analysis: This seems appropriate, though certain areas of the façade will be higher for emphasis.



Power Density (ASHRAE 90.1 2004):

Facade

ASHRAE Reference: Building Facades

Power Density: 0.2 W/ft²

Additional Allowance: none

Approximate Facade Area: 9120 ft²

Approximate Power Allowance For Space: 1824 W

Entrance

ASHRAE Reference: Building Entrances and Exits – Main Entries

Power Density: 30 W/ft of door width

Additional Allowance: none

Approximate Door Width: 6 ft

Approximate Power Allowance For Space: 180 W

Walkway

ASHRAE Reference: Building Grounds – Walkway Less Than 10 Feet Wide

Power Density: 1.0 W/ft of walkway

Additional Allowance: none

Approximate Walkway Length: 190 ft (within area studied)

Approximate Power Allowance For Space: 190 W



Design Criteria:

Most Important:

Appearance of Space and Luminaires:

- This is the façade that Franklin & Marshall College emphasized when they marketed the building on their website. The façade should be as distinct at night as it is during the day.

Direct Glare:

- This is a security issue. Luminaires that cause glare can temporarily disable people's vision, which is effectively the same as having no light at all, and removes a person's sense of safety.

Modeling of Faces and Objects:

- In order to make people feel more secure, they must have enough light to recognize faces. They must be able to see any object that might interfere with their path and any potential threats.

Points of Interest:

- Key parts of the façade to emphasize are the pilasters, the carvings (including the building name), and the entablature. Also important to draw attention to is the entrance.

Also Important:

Light Distribution on Surfaces:

- There should be no areas on the sidewalk or entry that appear dark, as dark is associated with unsafe. Spacing of the poles is going to have to be analyzed.



Luminance of Surfaces:

- Generally, most of the surfaces are darker than interior surfaces, and are going to have to be lit to somewhat higher levels than normal. No spot on the building can appear overly bright, as they would effectively create glare because of the dark surround.

Reflected Glare:

- Light can potentially be reflected by the glass and cause glare on people walking past the building.

Shadows:

- Fixtures must be aimed in order to keep shadowing off the walkways and entrances, in order to maintain a secure atmosphere.

Illuminance (Horizontal and Vertical):

- Good horizontal illuminance is required for the walkways and entrance. Good vertical illuminance is needed for the façade.

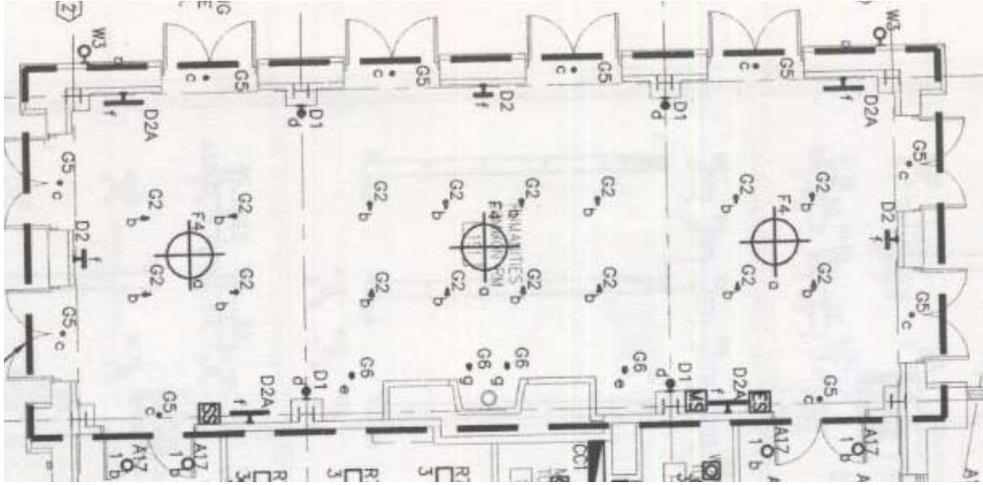
Lighting Analysis and Critique:

The walkways and entrance appear to have enough light, and the fixtures are at the right height for good facial rendering. Glare appears to be pretty well controlled, and security does not appear to be an issue here.

There is really no façade lighting to speak of at this time. Some of the key elements of the façade, including the name of the building, would get lost at night. Only the first story of the façade would receive much light at all. Emphasizing the pilasters and the entablature, and a general wash of light on the rest of the façade would add a lot to the nighttime appearance of the building.



Lighting Plan

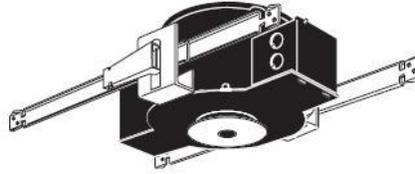


Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
F4	3	Ball & Ball	W136-E70-Raw Brass	Decorative 7-arm chandelier with 32" diameter	7	60W Inc	120
G2	12	Gotham	DLV-ADJ-MR16-1P-120-DWHG	Recessed 1" Adjustable pinhole accent light	1	75MR16	12
D2	3	House of Troy	Classic Traditional-14 INCH-1 ARM	Wall-mounted incandescent picture light	2	40W T10 Inc	120
G5	9	Gotham	DLV-DWN-MR16-1P-120-DWHG	Recessed 1" Fixed pinhole accent light	1	75MR16	12
G6	4	Gotham	DLV-ADJ-MR16-3AC-T30-LD-SL	Recessed 3" Adjustable low-voltage accent light	1	75MR16	12
D1	4	Ball & Ball	W173-E20-Raw Brass	Decorative 2-arm wall sconce to match chandelier	2	60W Inc	120
D2A	4	House of Troy	Classic Traditional-30 INCH-2 ARM	Wall-mounted incandescent picture light	4	40W T10 Inc	120



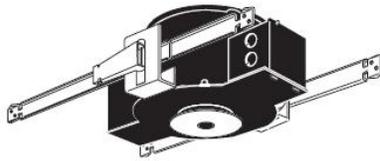
F4



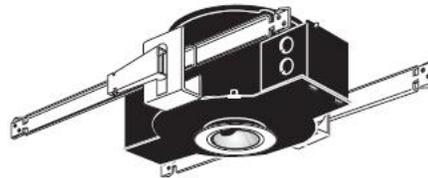
G2



D2



G5



G6



D1



D2A

Ballast Schedule:

All fixtures in this space are incandescent.

Light Loss Factors:

Label	LLD	LDD	RSDD	BF	Total LLF
F4	0.85	0.977	0.93	1	0.772
G2	0.95	0.958	0.96	1	0.874
D2	0.9	0.953	0.96	1	0.823
G5	0.95	0.958	0.96	1	0.874
G6	0.95	0.958	0.96	1	0.874
D1	0.85	0.977	0.93	1	0.772
D2A	0.9	0.953	0.96	1	0.823



Controls:

<u>Manufacturer/Family</u>	<u>Product</u>	<u>Quantity</u>	<u>Catalog #</u>	<u>Details</u>
Lutron Grafik Eye	Master Control Unit	1	GRX-4524-A-WH	
Lutron Grafik Eye	Programmer Interface	1	GRX-PRX	
Lutron Grafik Eye	Two-Button Entrance Control	1	SG-RS-RB-N-WH-E	Entry; 1 Scene and Off
Lutron Grafik Eye	Four Scene Controller	1	SGRX-4S-N-WH-E	main control for space

Surface Characteristics:

<u>Surface</u>	<u>Material</u>	<u>Color</u>	<u>Reflectance</u>	<u>Finish</u>
Ceiling - Flat	acoustical plaster	white	79%	semi-gloss
Ceiling - Beams	painted wood	white	70%	matte
Walls - Flat	gypsum board	pale yellow	60%	matte
Wainscoting and Trim	painted wood	white	70%	matte
Floor	wood	brown	10%	gloss
Hearth / Fireplace	bluestone	grey	20%	matte
Mantel	painted wood	white	70%	matte

Daylight Elements:

<u>Label</u>	<u>Quantity</u>	<u>Window Type</u>	<u>Mullion Pattern</u>	<u>Max Height</u>	<u>Max Width</u>	<u>Finish</u>	<u>Transmittance</u>	<u>Reflectance</u>
1EX9 (C-K)	8	French Doors	(2) 2X6 + top 4X1	7'-8"	6'-0"	Clear Tempered	70%	5%

Furnishings:

The only built-in furnishings are a fireplace in the center of the interior long wall, and a retractable projection screen immediately above the fireplace. Other portable furnishings will include tables, armchairs, and couches.



Illuminance Requirements:

IESNA Reference: Club and Lodge Rooms – Lounge (closest equivalent)

Horizontal Illuminance: 30 fc

Analysis: Some tasks may require 30 fc, but for the rest of the area, it seems too high for a gathering space. I will design to 20 fc for the majority of the space.

Power Density (ASHRAE 90.1 2004):

ASHRAE Reference: Conference/Meeting/Multipurpose

Power Density: 1.3 W/ft²

Additional Allowance: 1.0 W/ft² for Decorative

Approximate Floor Area: 1188 ft²

Approximate Power Allowance For Space: 1545 W + 1188 W for decorative

Design Criteria:

Most Important:

Appearances of Space and Luminaires

- This is an elaborate space designed for students and student organizations. The quality of finishes and the level of detail in this space are high, and the space needs to be lit well to emphasize these. Luminaires must be either recessed or high quality pendants to match the space.

Light Distribution on Surfaces:

- For a relaxing atmosphere, the goal is to have non-uniformity on the surfaces, particularly the walls. A uniform downlighting system is not going to be effective here.



Points of Interest:

- Points to focus on in the room are the fireplace at the center of the space and the area in front of it (for speakers). Of secondary importance are the paintings on the wall.

Surface Characteristics:

- The walls have two parts to them: a pale yellow base layer and white wainscoting. There are also 3 ceiling heights and detailed trims. These details are key parts of the spaces, and the lighting system needs to work with them.

System Control and Flexibility:

- This area is going to be used as both a student gathering area (for group meetings, reading, talking, etc.), as well as an organization meeting place. The system should be able to adapt to both very different tasks.

Also Important:

Daylight Integration and Control:

- The French doors opening to the Gardens are fairly large and face the south, which makes them prone to receive a lot of light. Shading or curtains might be a good option here.

Modeling of Faces and Objects:

- For group work and interaction, good facial rendering is key. Also, during organization meetings, the speaker will need to have good lighting on his/her face.

Reflected Glare:

- The wood floor appears to have a very glossy finish, so any strong direct lighting is going to cause reflected glare, which is especially bad for a space with a goal of relaxation.



Special Considerations (VDT/Projection Screen):

- A projection screen is not often going to be used, but when it is, it's going to be imperative that the lighting system be able to adapt to this.

AGI Model:

View 1





View 2





Lighting Analysis and Critique:

Despite the low lamp life and efficacy, I like the use of incandescent lamps here. Incandescent helps bring out the colors of the wood and the walls. Maintenance for this space is not too difficult, and so long as the owner is willing to have many bulbs replaced every few months, this system is a good choice.

I think the scale of the chandelier might be a little small for the space, but I think the style matches well with the space, and that's a critical thing for a fixture that is forced to become a focal point. Having the wall sconces match the chandelier added some consistency to the layout and overall helps the space.

I evaluated the lighting system in AGI32. On the ground, the average illuminance is around 15 fc, with some areas as high as 32 fc. In general, this is in line with most recommendations, though I would put the areas of 30 fc over the reading areas only, and design the rest down at 20 fc.

The control system used is a good choice here. The multiple scenes allow this space to be used well by both students and organizations. A photocell, or more daylight control, might be good to integrate into the main control system.



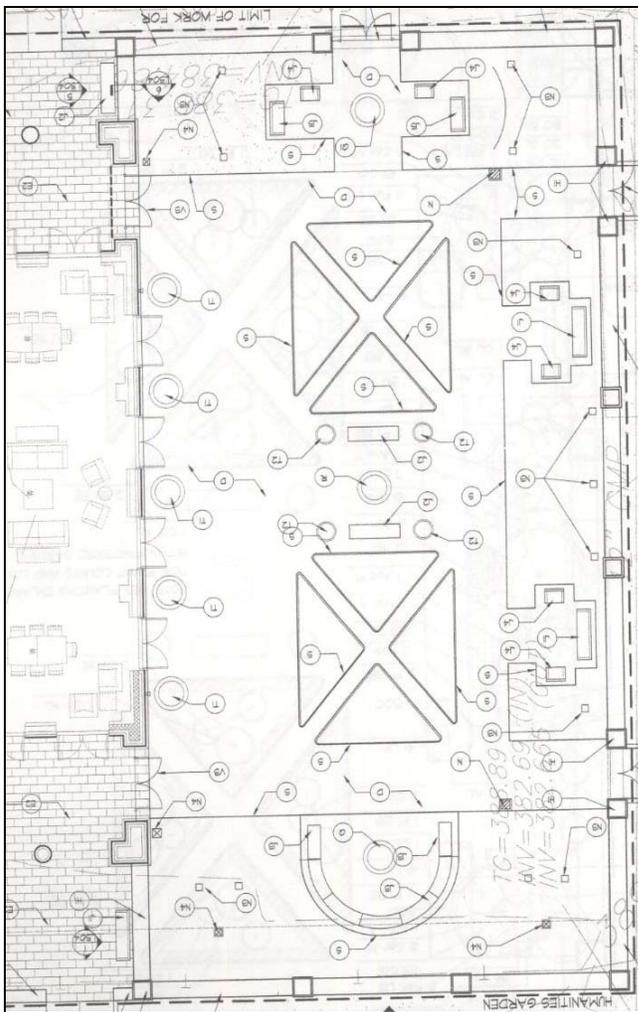
Humanities Gardens

Existing Lighting Overview:

Two decorative sconces are mounted on the south façade wall. Halogen uplights are recessed into the flowered beds.

Plans:

Landscaping and Lighting Plan





Fixture Schedule:

<u>Label</u>	<u>Quantity</u>	<u>Manufacturer</u>	<u>Catalog #</u>	<u>Description</u>	<u>Number of Lamps</u>	<u>Lamp Type</u>	<u>Voltage</u>
W3	2	Antique Street Lamps	DL42-100M MED-ACT- 277-ANBK- ACAWB	Wall mounted decorative exterior sconce	1	100W MH	277
N3	13	B-K Lighting	HP2-MR16- TR-8-BZP- 12-277- AH/CPC/GS	Ground recessed bronze landscape uplighting	1	50W Hal FL	12



W3



N3

Ballast Schedule:

<u>Label</u>	<u>Ballast Type</u>	<u>Min. Power Factor</u>	<u>Min. Ballast Factor</u>
W3	Magnetic HID	0.9	-
N3	none	-	-

Light Loss Factors:

<u>Label</u>	<u>LLD</u>	<u>LDD</u>	<u>RSDD</u>	<u>BF</u>	<u>Total LLF</u>
W3	0.65	0.78	0.85	1	0.431
N3	0.95	0.78	0.85	1	0.630



Controls:

Manufacturer/Family	Product	Quantity	Catalog #	Details
Interface K4000	Photocell	1	-	mounted on roof; determines when exterior fixtures will be turned on

Surface Characteristics:

Surface	Material	Color	Reflectance	Finish
Walls	brick	burnt red	30%	matte
Benches	wood	tan	45%	matte
Pier Caps	limestone	beige	50%	matte
Piers	brick	burnt red	30%	matte
Pathways	brick	pale pink	40%	matte
Pathway Band	bluestone	grey	10%	matte

Illuminance Requirements:

IESNA Reference: Gardens

Horizontal Illuminance: 1 fc (paths), 3 fc (flower beds)

Vertical Illuminance: 0.3 fc (paths). 3 fc (flower beds)

Analysis: I might aim for 2 fc for the paths for added security, but 3-4 fc should be fine for the flower beds.



Power Density (ASHRAE 90.1 2004):

ASHRAE Reference: Building Grounds – Special Feature Areas

Power Density: 0.2 W/ft²

Additional Allowance: none

Approximate Floor Area: 6384 ft²

Approximate Power Allowance For Space: 1277 W

Design Criteria:

Most Important:

Points of Interest:

- The focus of the space is on the flower beds distributed throughout the garden.

Also Important:

Direct Glare:

- Luminaires that cause glare can temporarily disable people's vision, which is effectively the same as having no light at all, and removes a person's sense of safety.

Modeling of Faces and Objects:

- In order to make people feel more secure, they must have enough light to recognize faces. They must be able to see any object that might interfere with their path and any potential threats.

Shadows:

- Fixtures must be aimed in order to keep shadowing off the walkways in order to maintain a secure atmosphere.



Illuminance (Horizontal and Vertical):

- Good horizontal illuminance is required for the walkways.
Good vertical illuminance is needed for good facial recognition and appearance of the vegetation.

Lighting Analysis and Critique:

The uplights appear to be highlighting the flower beds pretty well. The wall sconces provide some ambient light and help with facial rendering on some of the paths. The integration with the photocell makes control in that area much easier.

However, most of the walkways don't appear to have enough light for full nighttime security and enjoyment. I'd like to look at fixtures that light both the garden beds and the walkways with enough light to guide people through the gardens and emphasize the flower beds.

File Location

Y:\AE481 JPW\Tech 1 Files

Contains the AGI models for the Ecology Teaching Lab and the Humanities Common Room